

106A AMPLIFIER

TESTS, ADJUSTMENTS AND REQUIREMENTS

1. GENERAL

1.00 This addendum to Issue 1 of Section 024-102-500 is issued to advise that the 3A Noise Measuring Set may be used in place of the 2B Noise Measuring Set for the measurements outlined in this practice. It also discusses the relationship between dbrn and dba and shows how to express in terms of dbrn (3A NMS readings), the noise requirements given in this practice.

1.01 Noise measured with a 2B NMS, using F1A Weighting, is expressed in dba. Noise measured with the 3A NMS is expressed in dbrn. The numerical values of the readings on the two sets will not be the same because of the differences in the frequency response of the two weighting networks. Hence, there is no fixed conversion from dba to dbrn. Where readings on both sets are available, those taken on the 3A set give a more accurate indication of the circuit noise.

1.02 In general terms, the numerical value of metallic circuit noise rated in dbrn, as measured on the 3A NMS with C-Message Weighting, will be about 6 db higher than the numerical value of the same noise in dba, when measured with a 2B NMS F1A Weighting. Expressed in terms of *meter readings*, the 3A NMS (C-Mess.) will read about 13 db higher than the 2B NMS, F1A Weighting. Table I indicates how the noise requirements, objectives, meter readings, or dba (associated with the 2B NMS) as given in the practice may be adjusted to obtain the equivalent in dbrn associated with the 3A NMS.

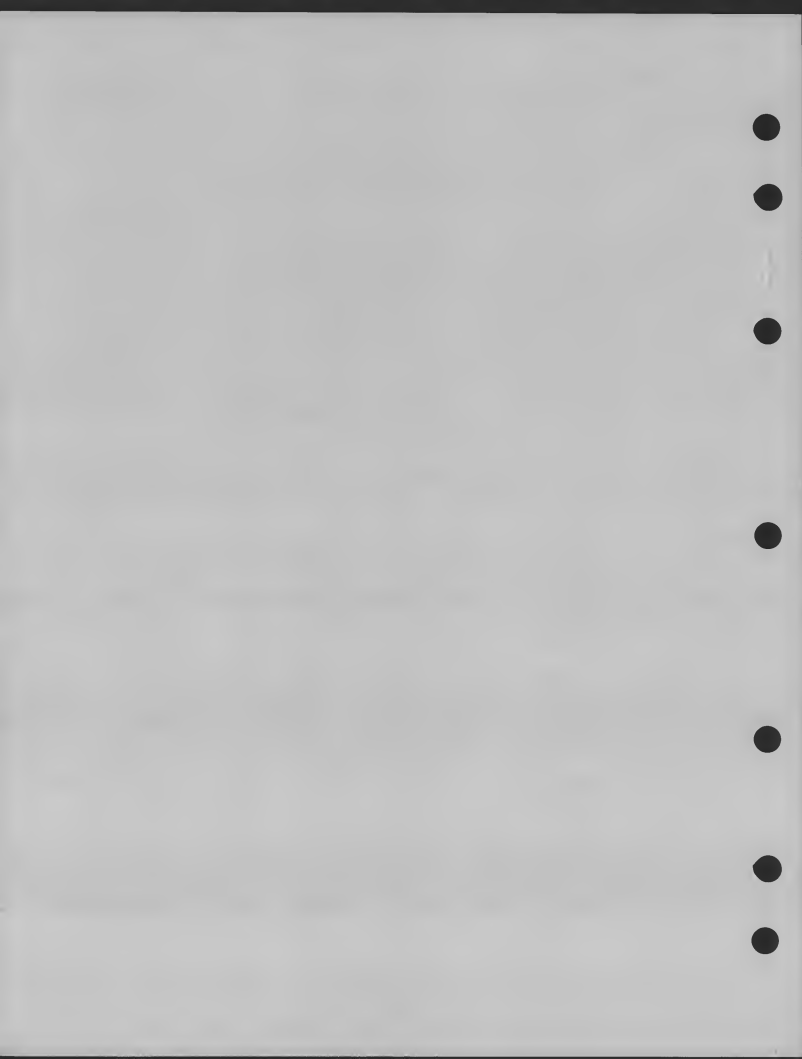
1.03 The 3A NMS (C-Message Weighting) may be used for voice frequency crosstalk measurements. Use Table C in Section E40.465/A702.644 to separate the noise and crosstalk in dbrn.

1.04 The 3A NMS and its operating features are described in Section E40.465/A702.644. The 2B NMS is covered in the E40.459 Series. Frequency Weighting curves for each of the sets are included in the respective practices.

TABLE I

Equivalent Noise Requirements and Network Weightings
Using the 3A NMS in Place of the 2B NMS

EQUIVALENT WEIGHTING		TO CHANGE NOISE REQUIREMENT, ETC., STATED IN THE PRACTICE, FROM:	
2B NMS	3A NMS	DBA (F1A) TO DBRN	METER READING* (2B NMS) TO DBRN
F1A	C-Message	Add 6	Add 13
Flat	3 KC Flat	—	Subtract 16
Prog	Prog	— See Note	—
* Uncorrected			
Note: Where the requirement in the Practice is stated in db above Reference Noise, no change is necessary.			



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TESTS, ADJUSTMENTS AND REQUIREMENTS

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1. GENERAL

1.01 This section describes the tests, adjustments and requirements associated with the 106A amplifier. It includes routine maintenance and trouble investigation tests. Included also is a schematic circuit diagram indicating various voltage measurements, and a wiring diagram.

1.02 Section 024-102-300 lists the initial and routine tests, as well as information on the frequency of routine maintenance tests, on 106A amplifiers.

1.03 A list of parts for, and a description of, the 106A amplifier is included in Section 024-102-100.

1.04 Test Equipment: The tests throughout this section require the use of the following test equipment:

- 1 - KS-14510 Volt-Ohm-Williammeter, Weston 779A Analyzer or equivalent

- 1 - KS-15560-L1 Tube Tester or equivalent
- 1 - 19C Oscillator or equivalent
- 1 - 13A Transmission Measuring Set or equivalent
- 1 - 5A Attenuator
- 1 - 2B Noise Measuring Set

The miscellaneous items necessary for the following tests are connecting cords and a 600-ohm resistor suitable for test terminations.

2. TESTS AND ADJUSTMENTS

(A) Primary Power Voltage Measurement and Adjustment

2.01 The purpose of this test is to determine which taps on the primary winding of the power transformer in the amplifier are to be connected to the a-c supply.

2.02 Apparatus:
KS-14510 Volt-Ohm-Milliammeter

2.03 Procedure:

- (1) Adjust the voltmeter for an a-c reading of over 100 volts.
- (2) Measure the a-c supply voltage at the fuse box or other convenient point between the fuse box and the amplifier.
- (3) Determine which terminals of the primary winding of the amplifier power transformer T3, shown in Fig. 5, are connected to terminals 24 and 25 of the amplifier.

Required Strapping: The correct terminals of the primary winding of the power transformer are determined as follows:

<u>A-C Supply Voltage</u>	<u>Terminals on T3</u>
105-115	1 and 2
115-125	1 and 3

Caution: In making these measurements care should be taken to avoid contact with line terminals.

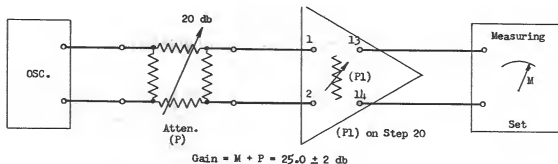


Fig. 1 - 106A Amplifier Gain Testing Arrangement - 600-ohm Input - 40-ohm Output - Maximum Gain

(B) Electron Tube Tests

2.04 These tests will check the tubes for correct operation in the amplifier.

2.05 Apparatus:

KS-15560-L1 Tube Tester

2.06 Procedure:

- (1) Test each tube in accordance with the information given in Section 100-635-501.
- (2) Discard any tubes which fail to meet the requirements.

Caution: When the amplifier is operating, the tubes will be too hot to handle safely. Use gloves or other suitable covering before removing a tube.

(C) Gain Tests

General

2.07 The tests described below determine the voltage gain of the 106A amplifier, and cover the two input arrangements available on the latter. A test covering the monitoring arrangement is also covered. In a particular case, the test need be made only for the arrangement actually used.

2.08 In all cases the output level of the oscillator is 1 milliwatt at 1000 cycles. The oscillator and transmission measuring set are connected together and the oscillator is adjusted until a reading of 0 dbm is obtained on the measuring set. The oscillator and measuring set are then reconnected to provide the arrangement for each test to be described. The gain of the amplifier is indicated by the algebraic sum of the attenuator loss and the meter reading on the measuring set.

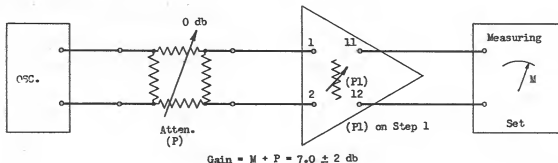


Fig. 2 - 106A Amplifier Gain Testing Arrangement - 600-ohm Input - 600-ohm Output - Minimum Gain

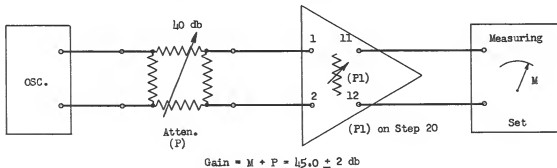


Fig. 3 - 106A Amplifier Gain Testing Arrangement - 600-ohm Input and 600-ohm Output - Maximum Gain

2.09 Apparatus:

19C Oscillator
13A Transmission Measuring Set
5A Attenuator
Connecting Cords

600-ohm Input and 40-ohm (Monitoring) Output (Maximum Gain)

2.10 Procedure:

- (1) Set up the testing arrangement indicated in Fig. 1, with attenuator P set for 20 db loss and potentiometer P1 in the amplifier on step 20.
- (2) Obtain reading (M) on measuring set.

Requirement: The gain should be $25.0 \text{ db} \pm 2 \text{ db}$.

600-ohm Input and 600-ohm Output (Minimum Gain)

2.11 Procedure:

- (1) Reconnect the input of the measuring set, readjust the attenuator P for 0 db loss and set potentiometer P1 in the amplifier on step 1 as indicated in Fig. 2.
- (2) Obtain reading (M) on measuring set.

Requirement: The gain should be $7.0 \text{ db} \pm 2 \text{ db}$.

600-ohm Input and 600-ohm Output (Maximum Gain)

2.12 Procedure:

- (1) Readjust attenuator P for 40 db loss and potentiometer P1 in the amplifier on step 20 as indicated in Fig. 3.

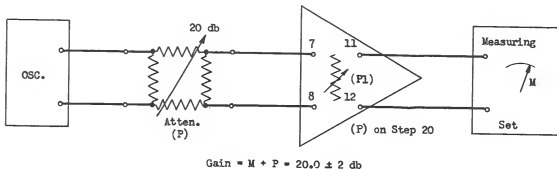


Fig. 4 - 106A Amplifier Gain Testing Arrangement - 10,000-ohm Input - 600-ohm Output - Maximum Gain

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- (2) Obtain reading (M) on measuring set.

Requirement: The gain should be $45.0 \text{ db} \pm 2 \text{ db}$.

10,000-ohm (Bridging) Input and 600-ohm Output (Maximum Gain)

2.13 Procedure:

- (1) Reconnect the input of the amplifier and adjust attenuator P for 20 db loss as indicated in Fig. 4.

- (2) Obtain reading (M) on measuring set.

Requirement: The gain should be $20.0 \text{ db} \pm 2 \text{ db}$.

Potentiometer Step-Gain Test

2.14 Procedure:

- (1) Set up one of the gain testing arrangements described in Paragraphs 2.10 and 2.11
- (2) Operate potentiometer P1 in the amplifier to step 19.
- (3) Obtain reading on measuring set and note the reduction in gain from maximum.
- (4) Repeat for each step on potentiometer P1, varying attenuator P as required to obtain a reading (M) on the measuring set.

Requirement: The change in gain between any two successive steps should be $2.0 \text{ db} \pm 0.5 \text{ db}$.

(D) Gain-Frequency Test

- 2.15 This test determines the performance of the amplifier over the bandwidth most generally employed.

2.16 Apparatus:

Same as under Paragraph 2.09.

2.17 Procedure:

- (1) Calibrate the oscillator at 1000 cycles as described in Paragraph 2.08.
- (2) Set up the testing arrangement described in Paragraph 2.12 and note the 1000-cycle gain.
- (3) Readjust the oscillator for an output of 0 dbm at 30 cycles and note the gain.

- (4) Readjust the oscillator for an output of 0 dbm at 10,000 cycles and note the gain.

Requirement: The deviation from the 1000-cycle gain should be within approximately $\pm 0.5 \text{ db}$.

(E) Noise Tests

- 2.18 These tests are made to determine the amount of noise produced by the amplifier at minimum and maximum gain.

2.19 Apparatus:

2B Noise Measuring Set
600-ohm Terminating Resistor
Connecting Cords

2.20 Procedure:

- (1) Calibrate the 2B noise measuring set in accordance with Section E40.459.1.
- (2) Insert the input plug of the 2B set in the LINE jacks and dummy plugs in the SOUND jacks. Operate K3 to FLAT and K4 to 144.
- (3) Terminate the input of the amplifier (terminals 1 and 2) with the 600-ohm resistor.
- (4) Set the potentiometer P1 in the amplifier on step 0.
- (5) Connect the output of the amplifier (terminals 11 and 12) to the IN terminals of the 2B set.
- (6) Adjust the potentiometer on the 2B set until a reading is obtained on the meter as described in Section E40.459. The algebraic sum of the potentiometer and meter readings on the 2B set, and a meter correction of -16 db indicates the amount of noise in dba.
- (7) Readjust the potentiometer P1 in the amplifier to step 20.
- (8) Determine the amount of noise as described in Paragraph 2.20(6).

Requirements: The following noise limits should not be exceeded:

P1 on Step	Noise	
	2B NMS	Corrected
0 (Min. Gain)	54 db	38 dba
20 (Max. Gain)	59 db	43 dba

(F) Cathode Current Measurements

2.21 This test may be made in order to determine the amount of cathode current flowing in each amplifying tube, and gives some indication of the condition of each tube.

2.22 A more complete test may be made by making standard tube tests as described in Part 2(B). However, if it is considered preferable to include the cathode current measurement tests for maintenance, they may be made as described below:

2.23 Apparatus:

KS-10003 or KS-7328 meter or equivalent. The latter may be a 200-microampere scale meter with a series resistor of such resistance that the total value of multiplier and meter resistance equals 1000 ohms. In this case, the readings in microamperes must be multiplied by 10 to obtain the actual cathode current of the first stage tube and by 200 to obtain the actual cathode current in the second stage tube.

2.24 Procedure:

- (1) Connect the meter to terminals 9 and 10 on the amplifier. The positive terminal of the meter should be connected to terminal 10.
- (2) Depress the key numbered 1 on the panel of the amplifier and note the reading on the meter. Release the key.
- (3) Depress the key numbered 2 on the panel of the amplifier and note the reading on the meter. Release the key.

Caution: Do not depress both keys at the same time as false readings will result. Total cathode current of both tubes can be obtained only by adding the separate currents.

Requirements: The following table indicates the cathode current limits. If these are not met, the tube checked is probably unsatisfactory and should be tested as outlined in Part 2(D) of this section.

<u>Electron Tube</u>	<u>Cathode Current Reading</u>
V1 (Key No. 1)	1.0 ± 0.2 milliamperes
V2 (Key No. 2)	34.0 ± 4.0 "

(G) Preliminary Trouble Locating Tests

2.25 When the amplifier is in trouble and the cause is not due to be burned out or otherwise defective tubes as indicated by tube tests, the amplifier should be checked (with a-c power switched off) for loose connections or broken wires involving the input circuit, output circuit, a-c supply, or exposed wiring. Fig. 6 shows a wiring diagram and Fig. 7 shows a bottom view of the chassis.

Caution: Avoid personal contact with terminals, especially those on electrolytic capacitors. The charge on some of these will be over 300 volts.

(H) Operating Voltage Measurements

2.26 If the tests mentioned above fail to reveal the trouble, it will be necessary to make a thorough check of the operating voltages. The schematic drawing of the amplifier, Fig. 5, shows the normal operating voltages in various parts of the circuit. The values shown are typical of those which may be expected when employing a 20,000-ohm-per-volt voltmeter and an a-c line voltage of 120 volts.

2.27 The values of voltages on the various elements of the electron tubes may be measured at the tube sockets on the underside of the chassis. The terminal on the socket to which each element of a particular tube is connected, is indicated by terminal number on the schematic drawing in Fig. 5. The standard numbering sequence for tube sockets is shown on the wiring diagram in Fig. 6.

2.28 The location of capacitors, resistors and other parts can be found by referring to Figs. 7 and 8. These figures show bottom and top views, respectively, of the 106A amplifier.

2.29 Apparatus:

KS-14510 Volt-Ohm-Milliammeter

2.30 Procedure:

- (1) Switch on the a-c power supply and wait for several minutes.
- (2) Obtain voltage readings, beginning at the output of the power rectifier tube, and working back through the circuit to the elements of the two amplifying tubes until an indication of the trouble location is obtained.

Caution: In making these tests care should be taken to avoid contact with live terminals. It should be noted that normal operating voltages of over 300 volts may be encountered.

(I) Distortion Troubles

2.31 If distortion originates in the amplifier, and it is not being caused by an input signal of too high a level, the trouble may be due to:

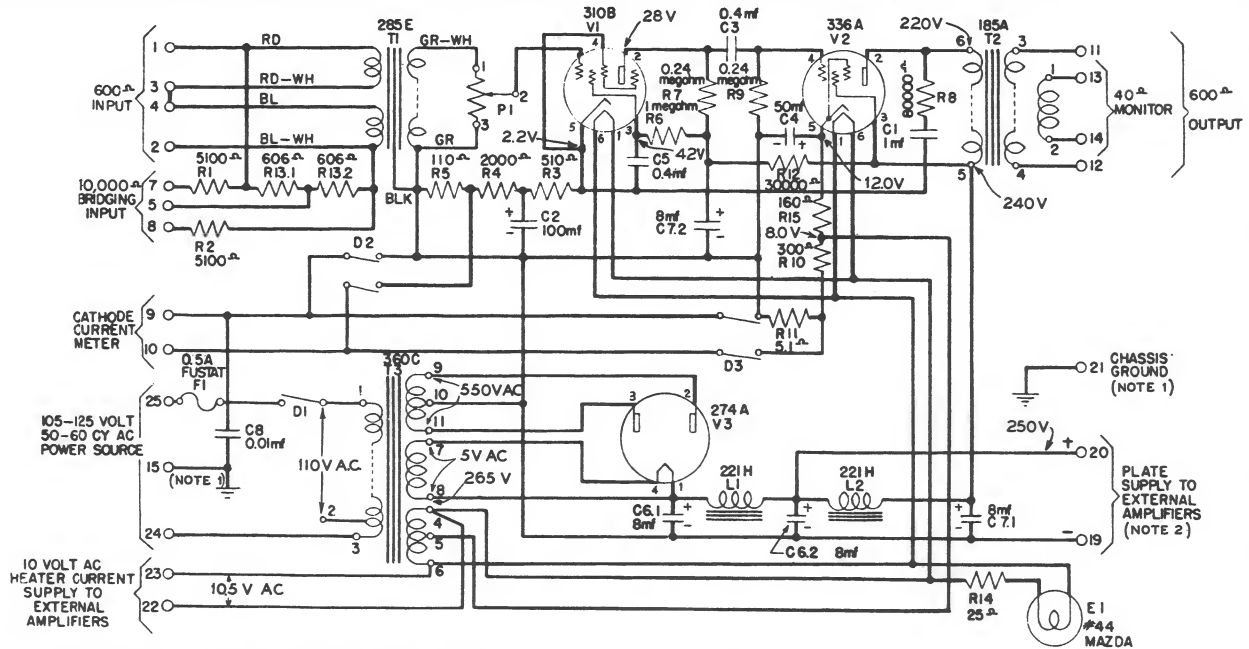
- (1) Defective electron tube.
- (2) Leakage in coupling capacitor C3.
- (3) Failure of biasing resistors or by-pass capacitors.
- (4) Failure or partial failure of input transformer T1 or output transformer T2.

2.32 There are other troubles which may produce distortion in the output. However, those listed above are representative of the more obvious types.

(J) Electrolytic Capacitor Testing and Replacement

2.33 The 106A amplifier employs a number of electrolytic capacitors for filtering and by-passing purposes. The dielectric film of these capacitors will deteriorate slowly if no voltage is impressed on their terminals. Accordingly, if an amplifier has not been used for several months, it may be necessary to attempt to reform the capacitor film. This may be done by following the method described in Section 032-110-701.

2.34 If the hum level of the amplifier is high after an attempt has been made to reform the capacitor film, the capacitors should be tested as described in Section 032-110-701, and replaced where the need is indicated.



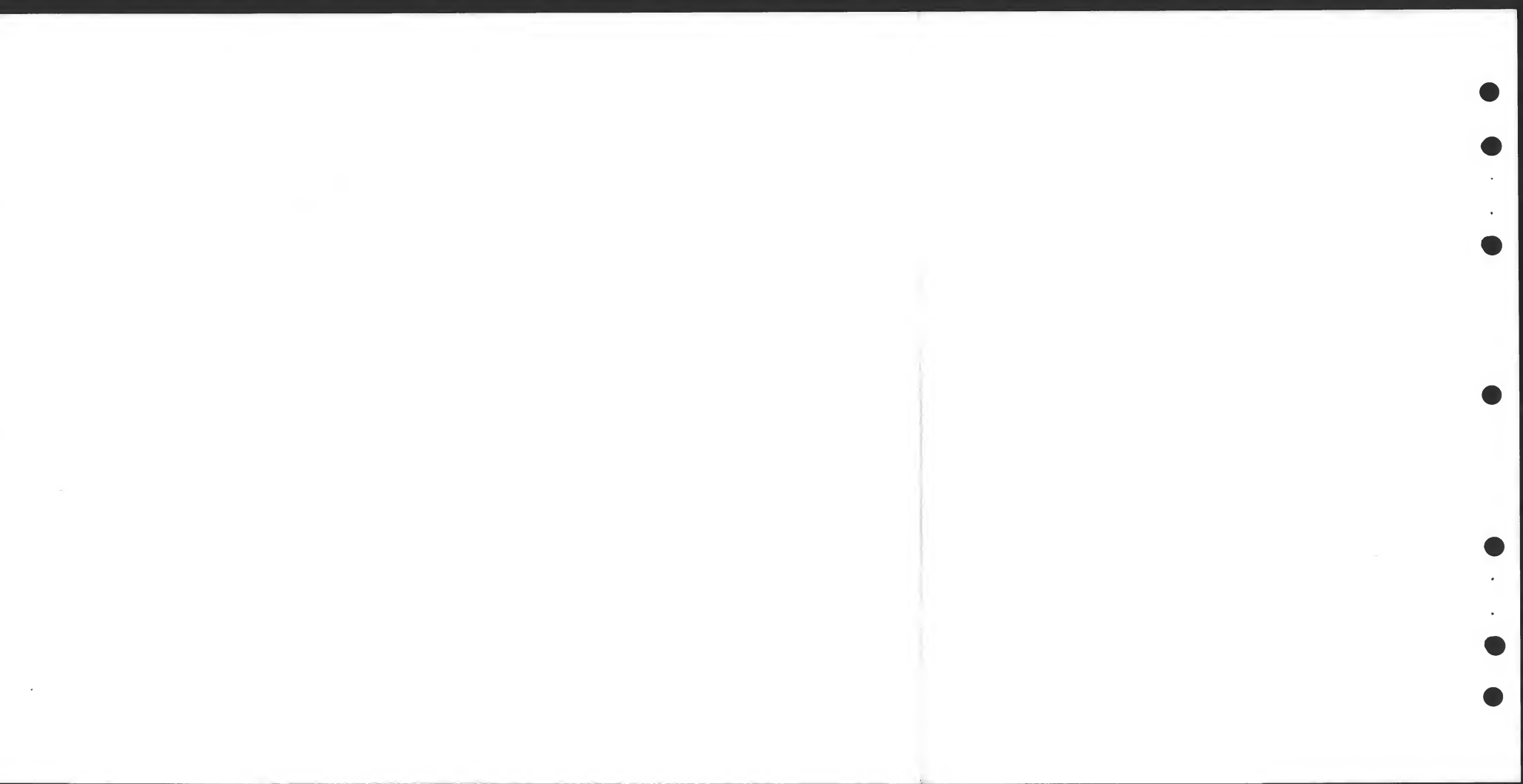
Note 1: Terminals 15 and 21 are connected to the chassis. A good external ground should be connected to either terminal 15 or 21.

Note 2: Terminals 15 and 19 should normally be strapped. If the 106A amplifier furnishes plate supply for external amplifiers, it may be found desirable to make the ground connection at the terminal strip of one of the external amplifiers,

instead of strapping terminals 15 and 21, in order to obtain the lowest noise level.

Note 3: All voltage values shown are typical of those measurements which may be expected within $\pm 10\%$ when employing a 20,000-ohm-per-volt voltmeter and an a-c line voltage of 120 volts.

Fig. 5 - 106A Amplifier - Schematic Circuit Diagram



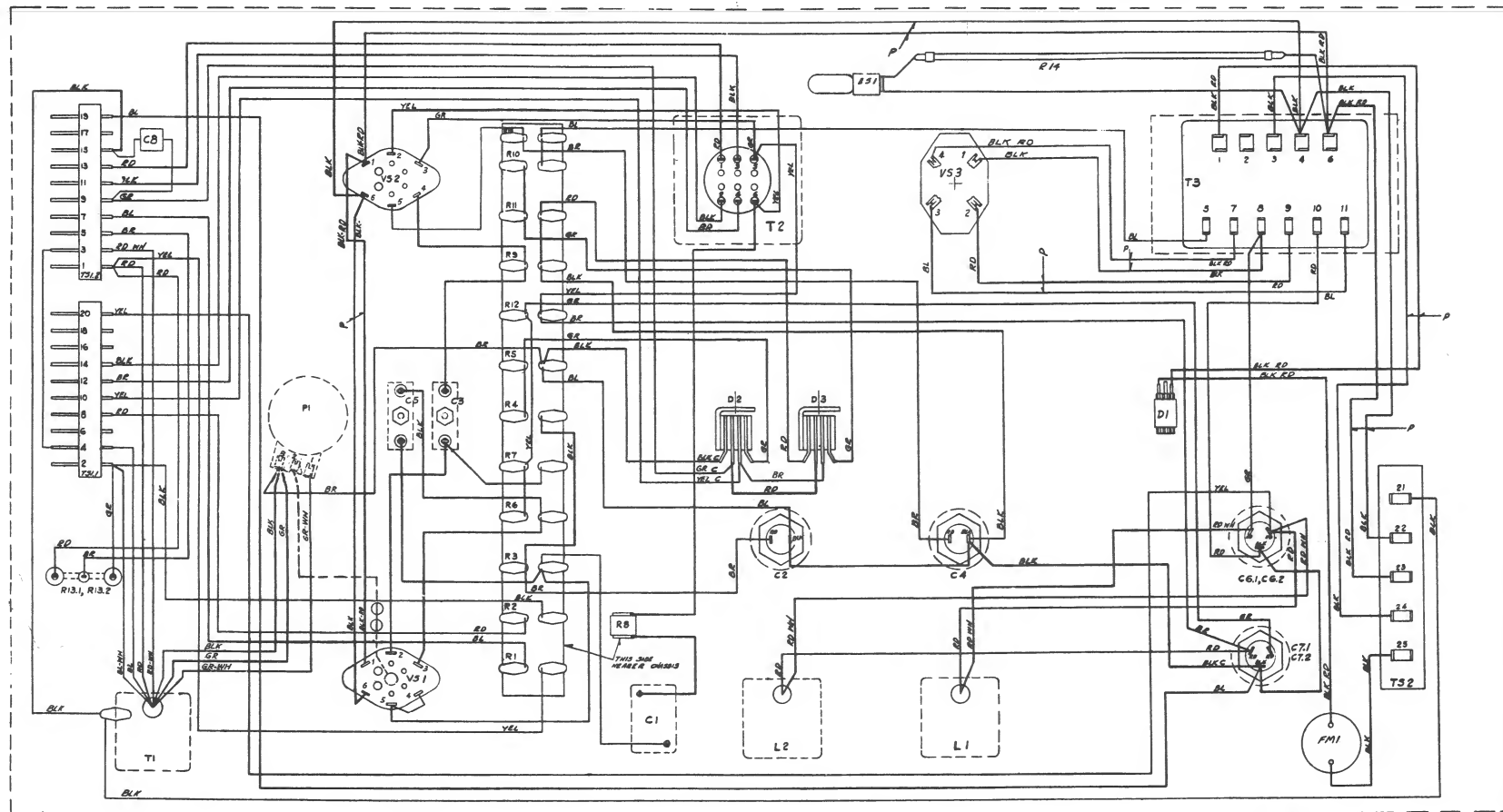


Fig. 6 - 106A Amplifier - Wiring Diagram



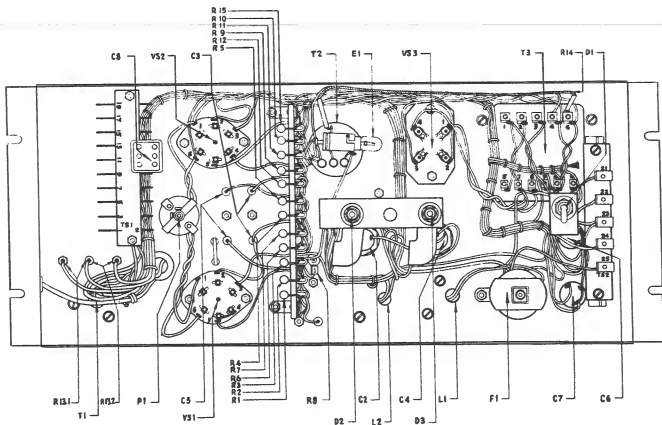


Fig. 7 - 106A Amplifier - Bottom View

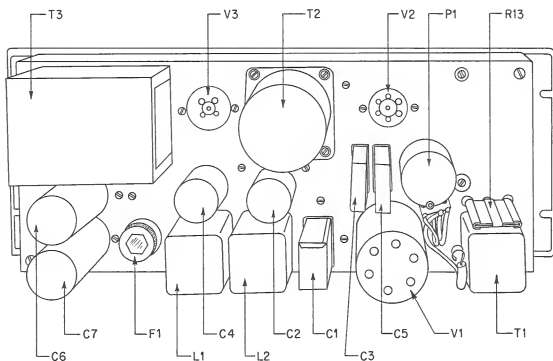


Fig. 8 - 106A Amplifier - Top View



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